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Improvement of Live-stock in Mysore.

BY

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IN order to discuss this subject from a proper standpoint, the cause of deterioration, reasons for a poor class of cattle, must first be brought to light and the methods of improvement discussed later. However, it may be fitting to mention at this point that any methods employed to bring about the improvement of stock on a large or even a small scale, will necessitate the expenditure of considerable sums of money, though in very few directions could money be spent to a better advantage, more especially in a State where the chief industry is agriculture and the chief power that of bullocks. Furthermore, with a breed of draught cattle, such as we find in the better sections and with such an outside demand for them as we find in other parts of India, and even in other countries, there seems to be no reason why money spent in the encouragement and production of better cattle should not yield a very handsome return to the State in the years to come. It should be possible to work up a large export trade for draught cattle, but first the needs of the State must be considered and a large

enough nucleus formed to carry on such a business. At the same time, it is only proper to point out that the work of effecting improvement in live-stock, more especially in cattle, is slow. One generation takes six years to reach maturity from the time of conception and several generations must be raised on proper lines before a permanent improvement and a fixed type can be expected. Furthermore, in a State containing over four million cattle alone, it is obvious that any action taken to further the production of better cattle must be done on a fairly extensive scale, if any appreciable result is to be effected within the next two decades. Moreover, the sooner the effects of such action become seen and felt, the quicker it will be supported by the general agricultural public and its effects become more general.

Speaking generally, improvement in stock can be brought about in two ways: by the importation of outside breeds for the purpose of introducing or strengthening desired characteristics, and by the selection and proper mating of animals already at hand, and possessing the characters needed in a fairly marked degree. Both of these methods can be employed in this State with profit, the former more particularly to increase milk-yielding properties, the latter to assemble the best draught qualities sufficiently in animals, so that they may be prepotent and leave their stamp upon ensuing generations.

Leaving a discussion of the former method till later, let us examine first those factors which are antagonistic to the production of a high class of animal in this State. They may be briefly enumerated as follows:—

1. Insufficient nutrition of young animals of both sexes, especially calves.
2. Lack of interest in heifer calves as compared to bull calves.
3. Large numbers of "scrub" or stunted and undesirable male animals left uncastrated and at large.
4. No proper system of mating.
5. Epidemic disease.

A brief discussion of the above may be profitably indulged in, though to do them full justice would require much time and space.

Insufficient nutrition of young stock, especially calves.—To any observant person, the condition of the average calf in Mysore is eloquent of the fact that he is getting barely enough food to live on, and certainly not enough for proper growth, many of them weighing when six months old, only a few pounds more than they did at birth. This gives these animals a set back which they can never overcome no matter how well they are fed and cared for later, weakens the constitution, retards maturity and can be regarded as nothing less than economic madness. At no time in the life of any animal will it digest its food as thoroughly nor make as cheap and economic gains as in its early stages of existence. As an animal grows older, it digests a lower percentage of its feed, puts on a lower percentage of body weight, and generally becomes a less efficient machine, and in order to take proper advantage of this fact, we must pay attention to the proper nourishment of animals from birth. Further, the stunted and starved calf will never regain its lost "calf flesh," and will never reach the same degree of vigour, constitution and growth as the animal which has been properly cared for from the start. This, in addition, causes delayed maturity, which is a matter of no small importance, and has a direct affect on the progeny. Continued repetition of this kind of treatment is, of course, bound to have a deteriorating effect, which will also be exercised in a cumulative manner as generations go on.

Lack of interest in heifer calves.—This applies in those districts where some interest is taken in the calves and where good bullocks are raised, as well as elsewhere. In a country where draught bullocks are the aim of the breeders, it is fairly easy to understand that more attention is paid to male than to female calves, but that the future mothers should be totally neglected and allowed to drag themselves toward maturity and attempt to complete their growth as well as grow a calf on a ration sufficient for neither, spells disaster for mother, calf and breeder. Furthermore, such a short-sighted policy delays

maturity, renders the animal unproductive for a longer space of time and lessens the number of calves which she will be able to produce, as well as lengthening the time between calves.

These two conditions should suggest their own remedy and the truth of statements made can be proved by any man for himself. That the dams do not produce enough milk for both calves and human consumption is well known and until better milking dams can be secured, the feed of young calves should be supplemented with grain and later with hay. Such feeds as rice-bran and the different cakes can be used with advantage and if given opportunity and a little encouragement at first, the calves will soon learn to eat and make good use of such food. As an encouragement and means of education in this direction, prizes could be given at the cattle fairs and jattras for calf classes in both sexes, as well as yearling and two year old animals. The present system of offering prizes in classes open to animals of all ages, naturally crowds out the younger stock, and leaves the field uncontested to the mature and full grown. In cattle as with ourselves, the rising generation is of prime importance and must be given special consideration.

The scrub bull.—The large number of “scrub” bulls to be seen in the State is one of its striking features. Thousands of bulls which should never have been allowed to reach maturity in an entire condition are at large in the State to-day and at liberty to serve all cows with which they come in contact. They are small, stunted, unthrifty, narrow-chested, short ribbed animals, with no indications of vitality or breeding about them. And these are to be seen not only in the backward sections, but also in those districts where good bulls are kept and appreciated, though the counteracting influence of these poor and undesirable sires seems to be regarded with stolid indifference and little or no effort made to restrict it. To eliminate the influence of the scrub bull and to widen the sphere of influence of the high class sire, co-operation of all members of a community is necessary. Early castration of unsuitable males must be practised and encouraged. The introduction of the “premium sire” system would be a great help in extending the influence of good sires, but would entail organization. This

system consists of selecting male animals and grading them according to a standard of perfection, and paying owners a premium for allowing these to stand for service in their locality at a low service fee. The best animals would be selected out of each district and only a certain number of premium animals appointed, according to the cattle population. The owners of these animals could take advantage of Government Orders at present in existence for the encouragement of stock raising.

Such animals could be selected by assembling all breeding bulls of a district and selecting there; or the jatra could be made use of in this connection. Competitive classes could be formed and prize winners selected for the above purpose. Such classes would tend to popularize this movement, and increase the advantage taken thereof.

Bulls of a high grade might be kept at all veterinary hospitals and dispensaries at taluk headquarters, and a small service fee charged to pay for maintenance. In considering suggestions, such as the above, let me point out the fact that the number of bulls required runs into thousands, so that some means must be provided to maintain and increase the supply of high class sires. Government breeding stations might be established throughout the State where good animals could be produced and distributed. Sires placed about the country will not exert much influence unless action is taken on a fairly extensive scale. The cost of organization is therefore likely to be heavy.

Improper mating.—That no system of mating is followed is the natural result of and in fact is really a part of the foregoing. To make a success of animal breeding, a definite policy must be followed and an effort made to attain some objective. Haphazard mating on a hit and miss system may, at times, be productive of a few good animals, but it is a wasteful method, and one to which continuity of policy is entirely foreign.

Epidemic disease cannot be said to affect the better animals more than the poorer kinds, but whenever a good class of breeding animal dies, a gap is made which cannot be filled up and the future influence of that animal ceases abruptly. Therefore, more serious efforts to control epidemic diseases and

prevent their spread are necessary, if the best results are to be obtained.

These then are the most superficial hindrances to the production of a high class of draught animal in Mysore State. Cattle of this kind are to be found in the State in fairly large numbers, and form a good nucleus to work upon. When we turn to the question of milk production however, the number of animals which pay for their keep from the standpoint of milk production may be regarded as negligible, and no hope for a marked increase of the milk yield of cattle indigenous to Mysore can be held out. In order that the milk yield may be increased, outside blood must be used. Extensive experimental work will need to be carried out in cross-breeding and an effort made to found a breed of cattle which will be able to withstand climatic and general conditions as will produce a high yield of milk. This will necessitate the expenditure of considerable sums of money, and call for time before a fixed type can be established. How far it is possible to combine draught and milk production in one animal remains to be seen, but in other countries where a dual type has been aimed at, it has been found that the tendency is for the two qualities to become separated according to the ideas of the breeders, who select from one standpoint more than the other, and this country is not likely to differ from other countries in that respect. In any case it will be some time before sufficient high milking animals will be available to affect the major number of animals in the State.

So far nothing has been said with regard to improving pastures, or the ability of land to stand an increased number of cattle, as that comes outside the sphere of a paper of this kind. The idea throughout this paper has not been to suggest means to increase the number of cattle, but rather to effect improvement and in the writer's opinion if an improvement were to be brought about at the cost of numbers, it would be no matter for regret, within reasonable limits.

SHEEP.

Up to this point, reference has been made especially to cattle. Although the remarks made in the foregoing are appli-

cable in the main to sheep as well as cattle, especially with regard to the selection of sires, as sheep are raised for different purposes than cattle, they may be discussed under a different head. The main purposes of sheep husbandry are the production of wool and mutton, and although in this country wool should be of more importance than mutton, it cannot be said to have reached a high standard. In addition to being of poor quality, the quantity per head is small. Of fifty adult ewes, which may be regarded as an average sample of Mysore sheep, the average clip was $10\frac{1}{2}$ ounces, and in only a few cases was the yield higher than one pound. Compared to the sheep of other countries, which produce an average of four or five pounds per head, this is very low. The mixture of colours, not only in the State, but in flocks and individual animals also works against production of an article capable of bringing a good price, rendering the wool unsuitable for dyeing purposes. The almost complete absence of pure white animals is noteworthy in this connection, white wool fetching the best price on the wool market.

To some extent, this may be overcome by the selection of the best wooled individuals for breeding purposes, and forming flocks of animals of one colour, so that a uniform product could be ensured. But to produce any marked increase in production and to improve the quality of wool, recourse must be had to outside blood notably the Merino, which is the outstanding wool breed of the world. Experiments already conducted on a small scale in the State seem to indicate that there are possibilities in this direction. This work should be continued on a much larger scale, so that in a few years' time definite knowledge and a fair amount of material would be available. This will entail the expenditure of considerable money, but on account of the quick breeding and early maturing habits of sheep, should lead to early results compared to work with cattle on the same lines. It may be said that the local demand for high grade wool is small, but that is undoubtedly because no wool of reasonably good grade has ever been available. There is no danger that high class wool produced in quantity will be a drug on the market.

From the mutton standpoint, there is also room for improvement. Admitted that mutton animals are all raised on pasture and not highly finished on a grain ration previous to marketing, the condition is often quite good, but the dressing percentage is low. Figures submitted to the writer indicate that there is a waste of 20 per cent more than is obtained in other countries, due to the presence of an undue length of leg and neck and insufficient development of the hind quarters and loins which give the best meat on the carcass and contain the least offal.

Here again, selection of breeding animals from those that possess the desirable qualities in the highest degree is the basic principle of success. The best males must be selected as sires, and the habit of indiscriminate breeding discontinued if the best is to be obtained.

In order to extend the work of breeding, and to test out hybrid animals in various parts of the country, it is my hope that some experimental work may be done in co-operation with breeders themselves. The scheme of such work would be as follows:—The breeder to dispose of all coloured sheep and to form a flock of pure white country ewes, headed by a white ram, which he may purchase himself, subject to approval from this department, or may purchase from the department direct at cost price. The breeder will be expected to give the department option on all stock for sale, and will be asked to sell all stock called out on inspection by Live-stock Expert or his representative. All monies derived from sale of stock or wool will belong to the breeder. In this manner flocks of white sheep will be established, which will be available for use when sufficient hybrid rams have been bred to be available for distribution and all breeders who have worked in co-operation with this department in this manner will receive first consideration in the distribution of such rams, and may be given flocks of improved ewes when such animals are ready for trial throughout the State. Readers, who are interested in this scheme, may communicate with the writer or the Department of Agriculture.

The Castor Semi-Looper.

A Serious Pest of the Castor Crop in Mysore.

BY

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CASTOR is one of the most important money crops grown extensively. Its value has increased very much recently owing to the various uses which the oil is put to. The plants are subject to the attack of a caterpillar which appears in large numbers and destroys the crop. The insect is popularly known as Kondalihula, Thondaluhula, Halukondali (as opposed to Uru-Kondali which is a hairy caterpillar) and Genuhakuva-hula (referring to the peculiar looping movement of the palm of the hand of a man used in measuring any surface). The pest has a very wide distribution not only in the Mysore State but throughout India.

The nature of the injury.—The nature of the injury consists in the caterpillars appearing in very large numbers and eating up the leaves and leaving only the hard and stout radiating ribs of the leaves in the case of old plants and eating up of the leaves wholesale with the exception of the stout leaf-stalk in the case of younger plants. When the plants are very young the top shoots and the tender stems of the plants to a small distance from the top of the plant are also eaten up. The insects are noticed as a pest by the raiyats only when the injury to the plants is quite marked, *i. e.*, a week or so after the real appearance of the pest.

Castor is generally sown in the Mysore State as a field crop after the outbreak of the South-west Monsoon rains in June and July. The pest generally appears by about the end of June and the beginning of July and continues up to about the end of September.

Life history.—The caterpillars are produced from eggs laid by a pale brown, stout-built moth which lays eggs on the under surface of the leaves of castor plants at nights. These

are not laid together in numbers, but each egg is laid singly. On each leaf from one to six or seven eggs are found. Each female moth is capable of laying about 400 eggs and the eggs are found distributed over the whole castor area. During day time the moths are found hiding under dry leaves, rubbish, shady and bushy plants or weeds.

The eggs.—The eggs are very small, round, and have a bluish green colour with an ashy bloom resembling the colour of the leaves more or less. Thus they are not easily detected on the leaves. The eggs hatch out into very small caterpillars in two to four days.

The larva.—The larva is very small on hatching out from the egg and is of a greenish yellow colour. At first it lives upon the epidermis of the leaves and as it grows older the leaves are consumed and it grows bigger in size. It is not possible to exactly describe the colour of the larva, as all shades of colour from ashy grey to dark brown and black are found. The larva goes on feeding and growing for 15 to 21 days when it becomes full grown. It is now a long, thin, smooth caterpillar of a dark colour, with red and white stripes along the sides, and the middle of the body having a hump like the pole of a palanquin. When full grown the larva descends to the ground to pupate.

The pupa.—The larva generally pupates between dry leaves and weeds found on the soil underneath the plants. It also pupates in dark and shady places, between the folds of leaves on the plant and also between fruit pods if they have been formed. A thin silken cocoon is built and the larva pupates inside this. The pupa is about an inch long, round at one end and pointed at the other. It is of a brown colour in the beginning and afterwards it is found coated with an ashy bloom. The pupa, if taken out of the silken cocoon and held on the hand, will be found to make circular wriggling movements with the pointed end of its body. The insect remains in this state from 10 to 14 days when the pupa bursts open and a pale brown moth—the parent of the future caterpillar—emerges out.

Thus it will be seen that for the full development of the insect from the egg to the moth stage it takes from 27 to 35 days. As each female moth lays 400 eggs and if we start with one moth or 400 eggs in the end of June, by the end of July there will be 400 moths. If half of these are considered as female moths, there will be 200×400 or 80,000 caterpillars by the 1st week in August and by the beginning of September there will be $40,000 \times 400$ or 16,000,000 caterpillars. Thus the progeny of one moth increases to such an enormous extent in two months' time as to destroy acres after acres of castor crop. Fortunately, this continuous increase is not allowed by nature to go on unchecked, as there are several natural enemies which reduce the number of the caterpillars to a great extent. These natural enemies are:—three kinds of wasps and one fly which live as internal parasites on the caterpillars and birds like crows, mynas, etc., which consume the caterpillars in numbers.

Remedies.—Several methods are adopted to check the ravages of this pest and to save the crop to a great extent, if not to completely get rid of the pest. These are mechanical and chemical.

Mechanical.—The simplest and the most effective of the mechanical methods is to have a sharp lookout for the first appearance of the caterpillars on the plants. Fields that are sown early are likely to attract the insects first. Hand-picking and destroying the caterpillars, as soon as they begin to hatch out, will be the best method to prevent the increase of the pest and to save the castor crop sown later in the surrounding fields. If the hand-picking and destruction of the caterpillars are not done in time, they increase to enormous numbers and the plants are eaten up very voraciously as they grow older.

The fact that birds like crows, etc., consume the caterpillars in numbers is well known to the raiyats and they make use of this knowledge in attracting large number of crows to the infested castor fields by throwing cooked rice balls in different portions of the fields. Birds, especially crows, are attracted in large numbers to these fields and they are found to make a hearty meal of both the cooked rice and the caterpillars. Other mecha-

nical methods are keeping the castor fields quite clean of weeds, dry leaves, etc., as these afford suitable pupating places for the caterpillars. As far as possible growing of castor as a mixed crop should be avoided. Stray castor plants in the fields and perennial castor plants growing in garden lands and backyards of houses form suitable breeding places when there is no castor crop in the fields. The insects should not be allowed to breed on these plants and the best course will be to destroy these plants and not to have any castor plants anywhere out of season.

When the above precautions are taken, it is almost certain that the pest will not become serious.

Chemical methods.—Chemical methods are resorted to when the other methods are not adopted properly and in time. They consist in spraying the castor plants with a poison mixed up in water, so that insects that eat the leaves coated with the poison die. It is rather costly, requiring spraying machinery and great care in the preparation and use of poisonous mixtures in the fields. It is not entrusted to the cultivators but is done only under the supervision of the officers of the Agricultural Department. The cost of spraying an acre of castor will be about Rs. 2.

Investigations are still going on to find out simpler methods in combating the pest very effectively.

The Cultivation of Baje Acorus (Calamus)

BY

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BAJE is grown under conditions similar to paddy. It is said to grow wild in certain creeks and lagoons and also in back waters of rivers. It is extensively grown in Malabar and South Canara where rainfall is over 100 inches. From its habits one can readily say that it must be a sea-weed. It is only here in Mysore that it is grown under irrigation. Close to Sosale village in Tirumakudlu Narasipur Taluk, it is found wild in pools of the Cauvery river, and in summer, between January and April,

villagers make money out of this. But it is only in the villages of Koratagere Taluk that it has been receiving much attention for many years past. The variety got from the seas and rivers is said to be inferior, so far as its medicinal properties are concerned, to that grown under artificial irrigation and manuring. The aroma of the former is also not so good as that of the latter. It is a pity that the market value of this commodity did not keep pace with the higher prices of other things. In fact, the price per maund which was between Rs. 5 and Rs. 6 during the last two decades, has gone down to Rs. 2, while the cost of cultivation has gone up. It is on this account that the area under bajé, which was between 50 to 75 acres, has suddenly come down to 10 to 15 acres to day. Besides the medicinal use to which it is solely used at present, it is said that a colouring matter can be extracted out of this.

Planting season.—Bajé can be planted at all seasons of the year provided there is facility for irrigation. But in Koratagere Taluk, it is generally planted between January to March, so that the harvest may come in next dry weather to enable the cultivator to get his stock prepared for the market. There are cases where it has been planted in other seasons also, but they are exceptional.

Rotation.—Paddy is the only crop that is generally rotated under tanks; but in garden soils vegetables also come in.

Preparation of the land.—The land is ploughed twice and allowed to dry for a fortnight, when the ploughed plot is irrigated to be ploughed in puddle, and then levelled by the levelling board. Hongay leaves are trampled in as in paddy land for manure. Two ploughings to break up the soil and one in puddle are generally sufficient. After the preparation of the land is over, transplanting of the seedlings is done in the following way.

The sets for planting consist of the cuttings from the rhizomes themselves. For planting only the part near the growing end of the shoot is used. At harvest time, the mature rhizomes are cut and removed for preparation for market and the tender part at the growing end is reserved for planting out, somewhat in the manner of getting "seed" sets for sugar-cane.

The cuttings can be kept for a week or ten days without damage before planting; but if further delay is anticipated, then they are tied up in bundles and preserved in a moist open pit.

Transplanting.—After the levelling board is used and green manure leaves are trampled in, the seedlings are transplanted in rows one foot apart and one foot in the row. The plants of the second row come in between those of the first row and those of the third row between those of second row and so on as shown below, so that plants of every alternate row are in a line.

1. o o o o o o o o o o o o o o o
2. o o o o o o o o o o o o o
3. o o o o o o o o o o o o o o
4. o o o o o o o o o o o o o
5. o o o o o o o o o o o o o o

Another point to be noted in planting is that the growing end of the rhizome imbedded in the soil should be in the direction of the flow of the water in the channel and into the bed so that the water may help lengthening the rhizome. The length of the root planted should be between 1 to 1½ inches. Twenty bundles, each weighing about two maunds of seedlings are required to plant an acre.

Weeding.—This is the costliest portion in the cultivation and requires to be done eight times during the growth, commencing from the second month. This costs Rs. 2 each time. During weeding all the dry leaves are removed and trampled in to serve as manure. At about the 4th or 5th month four cart-loads of powdered farm yard manure are broadcasted just before weeding for the month.

Harvesting.—The crop matures in a year which is observed by the yellow colour of the leaves. The lateral roots having gone down up to $1\frac{1}{2}$ to 2 feet below the soil, this operation is very difficult. In cases of luxuriant growth, guddalies are said to break during the operation. Iron ploughs and cultivators have also failed to be of use. For every maund dug green 0-8-0 is the cooly; cutting, drying, beating to remove the lateral roots

and rubbing to remove the scaly portion of the cortex and the portions of roots, another 0-4-0 is spent on a maund. Average yield per acre is about 150 mds. dry.

Preparing the produce for the market.—After the rhizomes are dug up, they are first cut into pieces of $1\frac{1}{2}$ " to 2" lengths and spread in the sun for four or five days to dry. These pieces are then beaten with sticks to separate the lateral roots adhering to them. When this is done, these pieces are put into gunny bags and rubbed on the floor by two men sitting opposite each other. This operation separates the small roots still sticking on them, and also the scaly portion of the cortex, and the produce is ready for the market.

Insect pests and plant diseases.—There is no pest and plant disease known to attack this crop so far; nor is there cattle grazing or thieving. In these respects, this crop has the best advantage over all the field and garden crops.

<i>Cost of cultivation per acre.</i>	Rs.	A.	P.
1. Three ploughings including puddling...	3	0	0
2. Levelling, half a day ...	...	0	4 0
3. Cost of 50 bundles Hongay leaves ...	5	8	0
4. Ten cart-loads of manure ...	10	0	0
5. Transplanting, 16 women at As. 2 a day.	2	0	0
6. Eight weedings, each Rs. 2 ...	16	0	0
7. Harvesting, drying, rubbing, etc., at As. 12 per md. ...	...	112	8 0
8. Assessment per acre ...	...	5	0 0
Total ...	154	4	0

Realisation.—Value of 150 mds. at Rs. 2

now, though it used to be

between Rs. 5 and Rs. 6

in previous years ... 300 0 0

Net profit ... 145 12 0 per acre.

Formerly ... 500 0 0

The relative availability of Oil-cakes in the Mysore Ragi Soil.

BY

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IT is a well-known fact that plants depend upon the available food material for their nutrition. A manure might contain a large percentage of food material as shown by chemical analysis but only a certain percentage of it might be available or none at all as will be shown later for the nutrition of our crops. Just as the nutritive value of a feeding stuff depends more on the available constituents than on the total, so also the value of an oil-cake or any organic manure depends more on the available constituents than on the total, so also the value of an oil-cake or any organic manure depends more on the Nitrogen made available by bacterial agency than on the total shown by chemical analysis.

When a manure is added to a soil, it undergoes many changes of which what effects its nitrogenous constituents is the most important. Formation of nitrates is the end product of this change and most plants take nitrogen in the form of nitrates. Therefore nitrifiability is chosen by many soil biologists as a safe measure of the availability of organic nitrogenous manures. Some of them notably Lipman and Burgess* have particularly emphasised this point. Burgess† has even gone so far as to say that a soil's fertility can be predicted by ascertaining its capacity to form nitrates.

With a view to ascertain how far the common oil-cakes at the disposal of the Mysore ryot nitrify in the most important

* Cal. Agri. Expt. Stn. Bull., 260.

† Soil Science, Vol. VI, No. 6, 1918.

soil of the State (*viz.*, the Ragi soil) the following cakes and the Ragi soil were obtained the experiments described below carried out :—

Number.	Name of the cake.	Nitrogen (Average of 4 analyses)
1	Mahua or Ippé cake	2.10
2	White castor cake	9.10
3	Black castor cake	6.60
4	Groundnut cake	8.517
5	Hongey cake	4.50
6	Neem cake	5.88

Cake was added at 30 mgs N. per 100 grms. soil as this proportion was found to be optimum. Optimum moisture was also found out and water added accordingly.

The soil used was the Ragi soil from Hebbal farm. It was sampled, sieved and then used.

400 grm. lots of dry soil were taken in each case, requisite amounts of cake and water added, the whole quantity mixed thoroughly with the hand and put into glass jars, covered with cardboards, tied with wax cloth and incubated for 8 weeks at 30 C. Any loss of moisture due to evaporation was made up every week. Amounts of ammonia, nitrites and nitrates were determined once in 14 days by taking soil equivalent to 100 grms. dry soil, making up to 300 ccs. with water, shaking for half an hour in the shaking machine. The soil emulsion was filtered till about 20 ccs. of the filtrate was collected and the rest was used for the estimation of Ammonia.

Nitrites and nitrates were estimated by the Griess-Ilosvey and Phenol sulphonic acid methods respectively from the filtrate, the colours in both the cases being matched in the standardised Tintometer.

From the acidified soil extract, which was left for 24 hours, aliquot portions of the supernatant liquid were distilled off with 30 per cent caustic soda and the ammonia was estimated by the

titration method, N/10 acid and alkali being used for the purpose. The results are tabulated below :—

Name of cake.	Milligrams of Nitrogen in the cake added	Milligrams of Nitrate Nitrogen formed after.....			
		2 weeks	4 weeks	6 weeks	8 weeks.
Groundnut cake ..	30	8	14	17	17 equal to 57% of Nitrogen contents of the cake.
Black Castor cake	30	7	13	17	17 equal to 57%
Ippe or Mahua ..	30	...	...	...	...
Honge cake ..	30	7.5	11	13.5	15 equal to 52%
Neem cake ..	30	6.5	11	13	17 equal to 57%
White castor ..	30	7	12	18	24 equal to 80%

It will be seen that 80% of N. in the white castor cake has been nitrified. This cake seems to be the best for manurial purposes for the Mysore Ragi soil as 80% of its N. is available for the nutrition of our agricultural crops. Both groundnut and black castor cakes nitrify to the same extent and almost in the same manner. Although neem cake is a bit slower than either groundnut or black castor cake, still it reaches the same percentage as the other two at the end of 8 weeks. For all practical purposes these three cakes may be said to be equal in value so far as their availability is concerned. 57% of their N. is nitrifiable.

Mahua Cake.—This is absolutely of no use as a manure so far as the Ragi soil conditions are concerned. There is very little ammonification and no nitrification at all. There may be some inhibitory constituent in the cake which if removed will make available this cake as a useful stuff in agriculture. It is reported from Nagpur that the same trouble is experienced with this cake in black cotton soil. It contains 2% to 3% N. (Nagpur mahua contains 3%). That means four to six times as much nitrogen as is contained in the farmyard manure. It is said to be available at comparatively cheaper rates than other cakes and any success to make it a useful

manure (*i.e.*, making it nitrifiable) would greatly repay the labours and will be a source of help to the poor ryot in his crying need for manures.

Areca Cultivation near Tirthahalli, Shimoga District.

From notes kindly furnished by Mr. Puttu Rao of Karodi near Tirthahalli; and compiled by V. K. Badami, L. Ag., Senior Assistant Botanist, Department of Agriculture, Mysore State.

THE general elevation of the valleys round about Tirthahalli is about 2,000 feet and they are narrow strips of lowlands winding amidst rugged groups of hills, well-wooded and well-watered. The soil is very poor and barren being only a thin crust overlying deep layers of laterite. Owing to the great fall in the lay of the land there is splendid drainage. The valleys that open out to N. E. direction are considered to be very good for areca gardens. The Areca Palm does not stand the western wind and the western sun scorches the exposed trunks. The Palm requires plenty of moisture for successful growth and therefore a heavy rainfall, a perennial stream or a tank are quite necessary for an Areca garden.

Nursery.—A well-drained moist situation is selected for this purpose, and drains are opened round about it. Ripe bunches are set apart for seed purposes and care is taken to protect them from rats. When a few ripe nuts begin to fall, the bunches are removed from the Palm. There are many varieties recognised here but a small nut is very popular. A late-maturing, long, thin, thin-shelled variety is considered to be the best in the locality. In this type the nut fills the whole fruit and it does not easily shed from the bunch.

The nuts are laid in baskets in layers of nuts and compost and the basket is placed in a moist place. The compost is made of equal parts of sand, manure and red earth and is well sifted.

The nuts germinate in about $1\frac{1}{2}$ months. After they germinate they are transplanted in beds 6 inches apart and the whole bed is covered with dry leaf mulch. When the seedlings are about $\frac{1}{2}$ a foot high $\frac{1}{2}$ an inch layer of manure is spread over

the bed and nicely incorporated into the soil. A dose of manure is given every year after the Magha Rain in September. In the second year all sickly and undesirable seedlings are rejected. A second transplantation is done at this stage when, the seedlings are planted a foot to foot and a half apart. The seedlings are transplanted a third time in the third year. They are finally planted in the upland places in the Aridra (June and July) rains and in the low moist places during the Magha rains. The seedlings are lifted with a ball of earth for planting. The pits are generally $2\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{2}$ feet. Half the pit is filled and the seedling is planted and trampled round. As the plant grows the pit is gradually filled up in a few years' time.

Planting.—Many systems are followed in planting but planting in rows 18 ft. 6 in. apart is considered to be the best and it is the famous "Daya" system of Sivappanaik. The main object is to plant as many palms as possible in the garden without retarding their growth and to get the maximum yield. Planting the garden in three stages as described below would have the largest number of palms in a garden and in this case no two palm heads would be nearer than $18\frac{1}{2}$ feet. This system would therefore give plenty of air and light for full development.

A new suggestion for planting areca palms :—

A	$9\frac{1}{4}$ ft.	C	$9\frac{1}{4}$ ft.	B	$9\frac{1}{4}$ ft.	A
—6' 2"—						
C		B		A		C
B		A		C		B
A		C		B		A
C		B		A		C
B		A		C		B
A		C		B		A
C		B		A		C
B		A		C		B
A		C		B		A

A—First planting.

B—Second „

C—Third „

Regular planting is done after digging the whole garden, breaking the clods and levelling it. After the first planting the plants are $18\frac{1}{2}$ ft. apart in the rows and the rows themselves are $9\frac{1}{4}$ ft. apart. These begin to bear in the 7th year. Second planting is then done. In the 14th year the third planting is done and at this time the whole garden gets full of plants. In 21 years they would all be in bearing. To afford them shade in the early stages cardamoms and plantains are planted along the water channels. The plants would be in full bearing from 15 to 20 years. They bear well up to even 50 years and they are supposed to live and pay up to a 100 years.

Cultivation.—A garden is divided into three parts for the purposes of cultivation. One portion is given a good digging, good manuring and a layer of fresh earth. The second portion receives a dose of green leaf in the shape of a mulch in December and a manuring just before the break of the monsoon. The third portion is left fallow without any sort of cultivation during the year. Channels filled up with silt are cleaned once in ten years and at this time a bund is raised in the centre of the bed to a height of a yard with fresh earth. The top of this bund is used for running the irrigation channel. Drainage channels are opened out in the place of former irrigation channels in the centre of the beds to a depth of $2-2\frac{1}{2}$ ft. with a width of $1\frac{1}{2}$ ft. at the top and 1 ft. at the bottom.

Thus the irrigation channels and the drainage channels change places. Within ten years the raised bund in the beds get washed out and the drains get scoured to a great depth, hence the necessity for the change.

Bearing.—There are two main crops in a year—Pushya and Magha. Phalguna flowers set and ripen into fruits in $9\frac{1}{2}$ months and are ready for gathering in November, December and January, and this is the late crop. The early crop is ready for gathering a month earlier in October, or November or December. The second gathering is supposed to yield the best nuts. Generally there are three gatherings in a season. There is an interval of 20 to 40 days between each gathering but if the nuts are picked out earlier there would be few 'Bettays'.¹

1. Over-ripe nuts.

Preparation of nuts.—The bunches keep good for a week after they are gathered. Those that are shed from the tree are immediately boiled. Boiling is done generally between 4 A.M. and 7 A.M. The boiled nuts are spread over a mat and allowed to dry in the sun for 7 days. They are generally placed over a 'machan'¹ in open yard and left undisturbed during the whole period. The dew acts on them during the night and increases the colour and appearance. But too much exposure to dew blackens the nuts and lessens their value. During the rainy season the nuts are collected and covered over by mats and crops gathered during the rainy period are generally dried on a machan over a smouldering fire.

Boiling.—For the preparation of Chogaru² Nerale,³ Rakthahonne,⁴ Manjatti root,⁵ Rama adikay kayi,⁶ Ambadi villedede,⁷ jaggery and gingelly oil are the articles used. Any amount of Manjatti, a piece of Raktahonne, and a big bundle of Nerale bark are put in a boiler after pounding. Betel leaves and a lump of lime about the size of an orange are then added to it and the whole thing is boiled to get a decoction having the consistency of gummy water. The whole thing is filtered and kept for use.

While boiling add $\frac{1}{2}$ seer of jaggery, one pav of oil and a bunch of green plantains. To boil 2 mds. of nuts we require 2 kodas (one kerosine tin), of chogaru an equal quantity of water, and 75 measuring seers of green nuts. There is much skill required in boiling the nuts to the proper point and this knowledge is acquired only by practice. At this stage the germ is easily pressed out of its own accord in the boiler owing to the swelling of the nuts. The nuts are boiled for three hours before they are spread in the sun. The liquid left after boiling is good chogaru and this is added to the original stock. Thus as the season

-
1. Over head platform.
 2. Colouring mixture.
 3. Jamoon. (*Eugenia Jambolana* Linn).
 4. Red sandal wood (*Pterocarpus Santalinus* Linn).
 5. Redwood tree (*Adenanthera Pavonia* Linn).
 6. A coarse big variety of arecanut.
 7. A variety of betel leaf.

continues the chogaru improves and in many cases the chogaru of one season is kept over for another season. In this case the floating thick mass is washed, dried and added to the fresh chogaru in the next season.

Classification of boiled nuts.—Classifying the boiled nuts is an important work in preparing the article for the market.

Class		Rs.	as.	p.	
A.	1. Hassa or Chikkani. ¹	sells at	11	0	0 per maund.
	2. Sanna bettay ²	„	5	8	0 „
	3. Dodda bettay ³	„	2	12	0 „
B.	4. Sanna dala or vanthige ⁴	„	11	0	0 „
	5. Yesala bettay ⁵	„	8	0	0 „
	6. Raja alu or (Dodda hassa) ⁶	„	10	0	0 „
C.	7. Petoona ⁷ (conical ones in Hassa)	„	15	0	0 „
	8. Gotu ⁸	„	1	6	0 „
	9. Gorugulu ⁹	„	1	6	0 „
	10. Bennumury or Sanyasi, ¹⁰ generally bought by Korachars	„	7	0	0 to 9 „

In this type the outside is pale brown and the cut surface is dark coloured.

Yield per acre.—On an average there would be about 1200 plants in an acre and of these about 800 might be bearing. As the yields between young and old trees would vary we may take

-
1. First class.
 2. Nuts from slightly ripe kernels.
 3. Nuts from ripe kernels.
 4. Small nuts separated from Hassa and used in counting nuts while grading.
 5. Slightly inferior to Hassa. These are from kernels which have begun to get hard.
 6. Bigger nuts in Hassa are sometimes separated into a grade extra first quality.
 7. Conical nuts in Hassa, small nuts in Hassa. They are from the crown ends of the nuts and fetch the highest price.
 8. Over ripe uncut kernels.
 9. Scraps from all grades.
 10. Nuts from Sann Bettay and other good grades. Owing to defective boiling the outer surface gets a pale brown colour and the cut surface a dark brown colour.

400 as the number of full bearing trees. An acre would bear somewhere between 20 to 40 mds.

Facts and Figures.

Cost of Cultivation.—(10 guntas) or 100 trees.

Digging, manuring and earthing.

Men work between 8 to 12 a. m. and 3 to 6 p. m.

and their wages are 8 as. a day, total 20 men ...Rs. 10 0 0

If they are paid in kind each man receives 2 as.

4 ps. or 30 men get Rs. 5 and get the following articles.

1 seer of rice per man.

1 seer of salt for 8 men.

1 seer of chilies.

1 seer of dhall.

Ten years ago if the work was given on contract, only the following things were given.

Rs. 2-8-0 for work and Rs. 2-8-0 for rations.

And a present of Rs. 4 for all or one varaha per head which is equal to 8 as.

Spreading of leaf—each man brings 9 head-loads	Rs. a. p.
at 8 as. per man we require 10 men	... 5 0 0

Manuring, 3 men	... 1 8 0
-----------------	-----------

One man for minor works—cleaning drains, etc.	... 0 8 0
---	-----------

Renewing earth once in 10 years.

200 men at 8 as. Rs.100 for one acre or for 100 trees	Rs.25 therefore for one year	... 2 0 0
---	------------------------------	-----------

Harvesting.—One man for cutting bunches and he removes about 250 to 500 and one man to receive them.

Climber 12 as. and rations or Re. 1 for 100 bunches, or Rs. 15 for 1,000 trees with 50 seers of rice or one khandaga of paddy.

Each tree bears 2 to 3 bunches and each contains about 150—200 nuts. A good crop is 40 mds. At Bhartipoor, Triyanpura, Koday Koppa, and Yedaguddi there are very large gardens having 50,000—60,000 trees.

On an average we get about one adi seer ($2\frac{1}{2}$ seers)—of 'adike' per tree.

Average crop is 18—20 mds. Land tax per acre is Rs. 15 to 20 per acre.

In an average crop the different grades of nuts would be in the following proportions:—

Soft kernel—(Hassa) 60—75%

Hard but not ripe nuts—(Bettay sanna) 10—20½%

Large-sized ripe nuts—(D odda bettay) 10—12½%

Over-ripe nuts—(Gotu and Kharab) 5—7½%

Grading—A cooly grades 2½ mds. per day and one bag contains 4½ mds.

Shelling.—One woman shells 10 kolagas in 10 hrs.

or for shelling 125 seers or 2½ khandagas, Rs. 1-1-0

or three khandagas for Re. 1-0-0 with rations.

One khandaga of green fruits give $\frac{1}{3}$ khandaga of green nuts.

75 seers (vol.) of green fruits give 2 mds. of prepared nuts.

20 seers (vol.) one md. or 28 lbs.

Subsidiary crops.

Cardamom.—There are two varieties, Mala—a big one and Thirupathi—a small one but of better quality. Plants raised from seeds begin to bear in 4 years whereas those raised from rhizomes bear in 3 years. They flower in May or June and the crop is ready for harvest in October. The capsules are dried over a slow fire or in the sun. A clump gives from $\frac{1}{2}$ a seer to one seer and the price of the article is now about Rs. 18 to 22 per maund.

Pepper.—One to two pieces of vine about a yard in length are planted near an areca palm in Magha or Aridra (June and July) rain and the plant begins to bear in 5 years' time. Harvesting is done generally in the months of February or March (Magha or Phalguna). Each tree bears about 5—10 seers. The seeds germinate in about 15 days and the plants are transplanted when they are one year old. But they bear in 6 years.

One man harvests about 5-6 trees in a day. The green pepper is dried in the sun for 6 days. For making white pepper the fruits are steeped in water for 5 days, the outer skin is washed out and the pepper is then dried. One plant yields about one adi-seer, and a md. sells at Rs. 11.

An average garden contains 10 acres.

3,600 bearing trees.

2,900 non-bearing trees.

Pepper 100—200 creepers.

Plantains 1,200 pits.

The following types of plantains are usually grown :—

Kare bale, a green type.	Dinde bale.
Vata bale.	Huvvu bale.
Puttu bale.	Nayndra bale.
Bude bale.	Pacha bale.
Rasa bale.	Salem bale.
Chandra bale.	Kalyane bale.
Betta bale.	

500 raw fruits are sold per rupee.

400 ripe fruits „ „ „ Fruits given on
gutha lease for Rs. 150 and leaves sold for Rs. 50.

The following betel leaves are commonly grown in this
locality :—

Kalasa vally.	Gobbara vally.
Lakka vally.	Karapoorra vally.
Pahcha vally.	Ambady.

Balance Sheet.

Cost of cultivation :—

			Rs.	a.	p.
Digging, manuring and earthing	80 men		40	0	0
Spreading 360 head-loads of leaves	40 „		20	0	0
Cleaning drains, etc. ...	4 „		2	0	0
Renewing earth once in 10 years,	200 „ at				
As. 8 or Rs. 100 per acre. For one year.			10	0	0
Harvesting Rs. 15 for 1000 trees with 50					
seers of rice or one khandaga of paddy.					
For an acre of 400 trees ...			20	0	0
Shelling: one woman shells 125 seers. For					
shelling 30 maunds. ...	6 women		6	0	0
Boiling ...	12 men		6	0	0
Drying ...	12 „		6	0	0
Grading, etc. ...	12 „		6	0	0
Collection and preparation of pepper } and cardamom ... }	10 men		10	0	0

			Rs.	À.	P.
Land tax	...	...	20	0	0
Other expenses	...	...	4	0	0
Total	...	...	150	0	0

Value of produce :—

22½ mds. Hassa at Rs. 11 per md.	...	247	8	0
3 „ Bettay at „ 5 „	...	15	0	0
3 „ Gotu at „ 1-8-0 per md.	...	4	8	0
1½ mds. Kharab, etc., at Rs. 1-6-0 „	...	2	0	0
Plantain fruits	...	15	0	0
„ leaves	...	5	0	0
Pepper, two maunds, at Rs. 11 per md.	...	22	0	0
Cardamom, one maund „ 22 „	...	22	0	0
Total	...	333	0	0

	Rs.	a.	p.
Value of Produce	333	0	0
Cost of cultivation	150	0	0
Profit	183	0	0

Kembatti Roga of Paddy.

BY

S. V. Venkatarayan, B.A.,*Asst. Mycologist.*

PADDY, in some parts of Kolar District, is subject to a fungoid pest, called Kembatti Roga in Kanarese, that seems to be of some economic importance. Before attempting to describe the disease, a casual remark has to be made about the practice of the ryots in styling all diseases of a certain crop by one and the same name.

Benki Roga, probably in allusion to the devastating nature of the disease and the scorched appearance of the leaves, is a quite different disease of paddy but this name has been applied in some places to the true Kembatti Roga. In one place reported to be attacked by Benki Roga there was actually no disease at all when a field inspection was made, although the crop was said to be drying about a fortnight previously. The probability is that

the name was applied to a minor illness, quite different from either Benki Roga or Kembatti Roga, which cleared off at the first shower of rain. The injury in such cases is all to the ryot if he begins to adopt remedial measures that have been prescribed for quite a different disease, of course, with loss and disappointment to himself and some discredit to the department. The best thing to do in such a case would be to send samples of the diseased specimens to the Mycological Laboratory to be examined, and a remedy prescribed.

Passing on to the subject in question, Kembatti Roga is to be recognised by the presence of small black dots scattered all over the leaves and leaf-sheaths. These dots contain the seed bodies or spores of the fungus causing the disease (*Cladosporium Oryzae*) which are blown about by the wind and thus spread the infection. The Benki Roga, caused by *Piricularia Oryzae*, on the other hand, appears in the form of spreading oval or linear brown patches on the leaves which may later run together. Thus, there is no possibility, for the trained eye, to mistake the symptoms of either disease. The effect on the earheads of both these diseases is alike, resulting in the formation of dwarfed or twisted ears, and the grains in most cases are undeveloped and are mere chaff. This is especially the case with a crop which is infected rather early in the season; if the disease is late in appearing a depreciation in the quality of the grain might result.

The fungus causing Kembatti Roga belongs to the fairly large section of saprophytes, that is to say, organisms living on dead or decaying matter. These organisms acquire, under certain conditions of temperature, moisture, and virility of the host plant, power to penetrate living tissues and bring on disease. Hence the cause of the disease is one essentially of the surroundings. The best and the most obvious remedy under the circumstances is to improve the methods of cultivation or the resisting power of the host plant by the addition of suitable fertilisers. In this particular case, it has been noted that the fungus thrives only on broadcasted paddy, and that it is strikingly absent from transplanted paddy. That, of course, suggests the line of improvement. Broadcasting has to be abandoned in favour of the more economic

method of transplantation, if for no other reason, but for the capability of the crop to resist the disease. But in the case of those places where transplantation is precluded owing to the uncertainty of the water-supply, the paddy may be sown in drills or even broadcasted very thinly so as to give the individual plants opportunity to grow vigorously. The case of the other disease, Benki Roga, is under investigation. This seems to be fairly common in Italy and Japan where it goes under the name of *Brusone*, and is supposed by many to be due to the deterioration of a variety. The growing of other better varieties, preferably from different sources, is the only remedy that suggests itself.

Lastly, a word may be said about the places of occurrence of the pest, Kembatti Roga. It was first noticed to a slight extent on a specimen taken from Goribidnur. Later, reports of the attack and diseased specimens were received from the Amildar of Malur Taluk through the Deputy Commissioner, Kolar District. It is prevalent round about Lakkur and has been reported from Masthi in Malur Taluk. While this note was under preparation a report has been received that the disease occurs in parts of Anekal Taluk in Bangalore District. Investigation is required to confirm the reports of attack in Masthi and parts of Anekal Taluk. The probability is, however, that the disease is fairly widely spread in the eastern part of the State.

NOTES AND COMMENTS.

BY THE EDITOR.

Additional Staff to the Madras Agricultural Department.

WE note that the Secretary of State for India has sanctioned the creation of the following ten new appointments to the Madras Agricultural Department :—

Three Deputy Directors of Agriculture.

Two Economic Botanists.

One Assistant Principal, Agricultural College.

One Second Agricultural Chemist.

One Agrostologist.

One Soil Physicist.

One Bacteriologist.

We congratulate the Madras Department on this new accession to its strength.

* * *

Improved Ploughs and large Farms.

The Fordson Tractor on the Gangenahalli Estate has been in full use during the whole of the ploughing season. The whole dry area was ploughed up ; odd corners, Lantana bushes, anthills, stiff bits which for years had never been touched by a plough were all ripped up ; the large stretch of ploughed land with its uniformly laid furrow slices was a striking sight.

In addition to ploughing, discing and cultivating with the double disc gang and a heavy Martin cultivator have also been in full swing in the season. This is a record of work which it would have required an impossible number of bullocks to have got through in the time and so well. Mr. MacIsaac gave an idea of what it costs to plough with the outfit in Vol. 1, No. 3, of our Journal.

We would also specially mention the enterprise of some of the larger landholders of the Kolar District, notably Mr. Lakshmana Reddi of Sabbanhalli, and Mr. Bapi Reddi of

Nagasandra who each keep over fifteen Kolar Mission ploughs at work during the ploughing season.

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Lantana Eradication in New Zealand.

The New Zealand Journal of Agriculture for May 1920 contains a detailed description of our familiar friend the Lantana, which is prefaced with this announcement: "By order in Council gazetted on 27th November 1919, the subject of this article was added to the third schedule of the Noxious Weeds Act *i.e.*, it is a noxious weed when so declared by the local authority". We must congratulate our friend on this formal though tardy recognition of his merits, and the New Zealand farmer will now have to enter into a state of war promptly with this Ishmaelite of the farm. An act on similar lines would do a great deal of good in our state, where some vigorous measures of stamping out the pest are urgently called for.

* * * *

The Oliver one-furrow deep Plough for Tractors.

We understand the Oliver Co. is introducing a one-furrow plough for use with Tractors, which will plough 12" deep. It may be remembered that their two-furrow plough, usually sent out with the Fordson Tractor which is probably the best among ploughs of that type, will not do for the deep ploughing required on the black cotton soils when used in conjunction with the new light tractors. It has been suggested that, with a suitable one-furrow plough, such work can be got through with the help of these tractors. The new one-furrow plough referred to is said to be for ploughing potato land in England. We hope it will be possible to try it on our black cotton soils at some early date.

* * * *

Of interest to Coffee Planters.

We read that the prohibition of alcoholic drinks in the United States has drawn public notice to the increased use of non-alcoholic stimulants, among which coffee figures largely and that the consumption of coffee will greatly extend in the future not only in the United States but throughout the world. This should be good news to our coffee planting friends. The note

also states that, as "between tea and coffee as stimulants, the latter is preferable, for coffee supplies more nutriment than tea and is not so likely to interfere with the digestion nor does it irritate the nerves in the same manner" which, if true, our tea planters will not like of course. But we do not know how long America will remain dry and see all her alcohol used for internal combustion rather than for internal consumption in the good old way!

Petter Combined Engine and Pump.

Messrs. Petters, Ltd., well-known for their compact little Petter Engines, advertise a pumping outfit consisting of a Petter engine and a pump both mounted together and forming a handy unit. This arrangement will avoid the necessity for a separate engine house where an engine-driven pump has to be installed, with the other inconvenient arrangements necessary for suitably connecting up the engine with the pump. The combined outfit can on the other hand be easily fixed on a platform at whatever height desired over the well within the suction limit.

A 2½ H.P. hopper-cooled Petter engine and a 4" pump capable, it is claimed, of pumping 1,000 gallons of water per hour up to 150 feet including 25 feet of suction, is priced at £ 90.

Nitrification of Indian Oil-cakes.

We invite attention to the study into the nitrification of the different local oil-cakes on Mysore soils contributed to the current issue of the journal by Mr. Adinarayana Rao. The curious fact brought out regarding the total inertness of the Ippé (Bassia Latifolia) Oil-cake is very interesting. During the 8 weeks of the experiment in which the cakes were put out to nitrify under what he considers optimum conditions, the Ippé cake failed absolutely to nitrify while the other cakes nitrified to varying degrees from 80% down to 52%.

Ippé is the poorest among the various Indian oil-cakes in nitrogen content and so far we have never seen it used as manure. We have heard that considerable quantities of it are sent out from the Maddagiri and Koratagere Taluks to the Coffee Estates,

apparently for use as manure by itself or mixed with other cakes. If this is so, this new fact brought out in the study should emphasise that it is so much money thrown away.

* * * *

Distance to plant Sugar-cane.

It may be remembered that experiments conducted on the Hebbal Farm show that higher yields of cane are obtained when canes are planted in rows 3 feet apart than when they are planted closer. Thus the results of three years experiments showed yields of cane per acre as under :—

One foot spacing.	24·9 tons.
Two feet „	28 „
Three feet „	29·2 „

A further one year experiment gave results in favor of a still wider planting *viz.*, 4 feet.

Experiments in the West Indies also demonstrate the value of wider planting. In these experiments different spacings not only of the rows but also of the cane sets in the rows were compared. The results, which we extract from the Agricultural news are given below:—

<i>Planting distance.</i>	<i>Yield of cane per acre in tons.</i>
5 ft. x 2 ft.	37·3.
4 ft. 6 in. x 3 ft.	39·6.
4 ft. x 2 ft.	40·5.
3 ft. 6 in. x 3 ft. 6 in.	41·5.
3 ft. x 3 ft.	43·7.

These are results of only one year, but each of the series consisted of six 1/10 acre plots, and the probable error was well within the limit considered allowable in such trials. The author draws attention to the fact that the “square” planting, *i. e.*, the cane sets separated by equal distances on all sides, was better than “oblong” planting, and that a three feet distance both ways was the best.

* * * *

State-aided Beet Sugar Factory to be opened in England.

The failure of India to manufacture sugar on a large scale and on modern lines is somewhat on a par with the failure of

England to manufacture beet sugar. The British public grouses as often over its shortcomings in this respect as we find ourselves doing in this country. Conditions seem however to be changing, and we read of the formation of a very large British Company for the growing of sugar beets in England and the manufacture of sugar. The Company receives very liberal assistance from the Government, and as similar projects are under contemplation in our own country, some details of this scheme may be of interest. The authorized capital of the "Home Grown Sugar, Ltd.," is £ 1,000,000 in £ 1 shares; the present issue consists of 500,000 shares. The Government assists the Company firstly by subscribing for 250,000 shares *i.e.*, fully 50% of the present issue and secondly by guaranteeing a dividend of 5% on the capital subscribed by the public up to 250,000 shares, for a period of ten years. The intention of the Government is to stabilise the industry during the earlier years as a profitable commercial proposition by ensuring this 5% dividend, and when so established, to encourage the Company to divest itself of Government control. For that reason the Directors may, at any time when their funds allow, buy out any or all of the State holding.

It is proposed to erect the factory so that it will be ready to handle the crop of the autumn of 1921. Its capacity will be 600 tons of beet a day *i.e.*, in a normal campaign 60,000 tons of roots, the produce of 6,000 acres equivalent to 8,000 tons of sugar. The estate itself will supply 6,000 tons of beet, the remainder will be grown by farmers in the neighbourhood for the factory on contract.

The Company expects to earn a net profit of £ 54,000 on a total capital of £ 500,000 or about 11%.

* * * *

Ongole Cattle-breeding and Export.

Readers of our Journal, who may have perused our notes entitled "Should the cattle trade be controlled" in the last number of this Journal, will be interested in the following announcement by the Madras Publicity Board regarding the action taken by the Government of Madras.

"The Government have carefully considered the question as to how far export of Ongole cattle to Java and other foreign

countries has been detrimental to the breed and whether any steps should be taken to prohibit such export and are of opinion that the deterioration is not due to export alone and that other means should be adopted to improve the breed. The Board of Agriculture, which met at Pusa in December 1919, recommended that, with a view to increasing the supply of animals to meet increased demands consequent on the change in economic conditions, Local Governments should encourage and foster the cattle-breeding industry by the establishment of farms in breeding tracts, by the distribution of breeding stock and by propaganda. It was further suggested that endeavours should be made to fix a standard of quality for the different breeds on a quantitative basis with a view to gauging the extent of any deterioration or improvement that might take place.

2. The Government have already sanctioned the opening of a cattle farm at Chintaladevi in the Ongole tract, and proposals to open one in the Kangayam tract have also been approved and bulls from these farms will be put out for stud purposes or sold every year.

3. The Director of Agriculture will consider what other steps are possible to secure the breeding of the best types of cattle in the Presidency and report to the Government from time to time on the measures he proposes.

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Legislation for the Protection of Cattle in Ceylon.

The Government of Ceylon is attacking the question of a depleted stock of agricultural cattle in the island by legislation with a view to control the slaughter of these animals for beef. We give below the draft of the ordinance which we understand has now passed into law. We may observe in this connection that there is a growing complaint in our country itself regarding the slaughter of cattle in increasingly large numbers in the various slaughter-houses in the country. It will not do to put down the outcry as due to religious sentiment, although even this is a factor that cannot be lightly brushed aside. There is evidence on all sides that the consumption of meat of all kinds is on the increase and that the agents of the butchers in the cities

scour the country far and wide to keep these central abattoirs well supplied. Increasingly large prices are offered for the ryots' cattle and this added to the difficulty of maintaining cattle in these days of costly feeds constitutes too great a temptation to the ryot. Cows which have gone dry and which therefore do not pay for their keep suffer most in this respect, and in addition to the large number of ordinary cows, even cows of outstanding merit are often sold to butchers especially in the big cities. Watching the large numbers of butchers' cattle that frequently come into Bangalore along the main provincial roads in the State we have often been struck in recent years with the quality of these animals which are much superior to the old and decrepit cattle that used to be the only ones to be seen some years ago. Without going further into the question whether how far this is an economical evil, we may only mention that in the peculiar conditions of India such a depletion of cattle has always been looked upon as an evil. Even under the Mahomedan rulers of India, it is on record that firmans were issued forbidding the killing of cows especially in the years following a famine or the devastation of a war.

The text of the Ceylon Ordinance referred to above is as follows:—

“Whereas for the purpose of securing the supply of buffaloes available for agricultural purposes, it is deemed expedient to make provision for restricting and, if need be, prohibiting the slaughter of buffaloes”: Be it therefore enacted by the Governor of Ceylon by and with the advice and consent of the Legislative Council thereof, as follows.—

1. This Ordinance may be cited as “The Buffaloes Protection Ordinance, 1920.”

In this Ordinance, unless the subject or context otherwise requires—

The expression “local authority” denotes a person falling under any of the descriptions hereinafter following, *viz.*,

- (a) Within the limits of a Municipality, Local Board or Sanitary Board, or the Board of Improvement of Nuwara Eliya, the Chairman of such Council or Board;

- (b) Outside the limits of a Municipality, Local Board, or Sanitary Board, or the Board of Improvement of Nuwara Eliya, and within the limits of a province or district, respectively the Government Agent or Assistant Government Agent thereof.

(1) The Governor in Executive Council may, in respect of the whole Island or of any particular area or areas therein, make rules for restricting, controlling, and regulating the slaughter of buffaloes, and, without prejudice to the generality of the powers so conferred, such rules may—

- (a) prohibit the slaughter of buffaloes, except on the permit of the local authority;
- (b) prohibit the removal of buffaloes or the transport of buffalo meat from one area to another, except on the permit of the local authority;
- (c) prescribe the form of permits to be issued;
- (d) authorize such local authorities to grant or refuse such permits absolutely or upon conditions.

(2) All rules made under the provisions of this section shall be published in the Government Gazette, and when published shall have the same force and effect as if they had been enacted in this Ordinance.

In any case in which it appears expedient so to do, the Governor in Executive Council may, by a Proclamation to be published in the Government Gazette with respect to the whole Island or any part thereof, prohibit the slaughter of buffaloes as and from a day to be appointed therein; and, so long as such Proclamation shall remain in force, the rules, if any, made under section 3 hereof shall be deemed to be suspended in so far as they are inconsistent with such Proclamation.

Any person committing any breach of any rule made under this Ordinance, or acting in contravention of a Proclamation made under the provisions of the above section shall be liable on summary conviction before a Police Magistrate to a fine not exceeding five hundred rupees, or to imprisonment of either description for any period not exceeding six months, or both.

This Ordinance shall not apply to buffaloes specially imported into the Island for the purpose of slaughter, but the onus of proving that any particular buffalo was so imported for the purpose of slaughter shall lie on the person who affirms it.

Statement of Objects and Reasons.—The object of this draft Ordinance is explained in the preamble. The limited supply of buffaloes available for agricultural purposes is being so seriously depleted by the slaughter of these animals for food that it is deemed necessary to take power to control, restrict, and, if need be, prohibit slaughter."

* * * *

Restriction of the Export of Fertilizers.

Restriction and control by legislative action seems to be the order of the day. The debate in the House of Commons when the Secretary to the Ministry for Agriculture introduced a bill to continue for a further period of two years the prohibition of the export of fertilizers from England except under strict control is full of interest to us. It may be remembered that one of the commonest and most frequently suggested measures for the improvement of Indian Agriculture is some scheme by which the large export of bones and oil seeds from the country may be prevented so that they could be utilized within the country to be used as bonemeal, superphosphate and oil-cakes for manurial purposes. Indian soils are woefully deficient in nitrogen and phosphate and could ill-afford this annual drain which the ryot is too poor to make up by liberal manuring.

In wealthy England the Secretary characterises an unrestricted export of fertilizers as positively disastrous to agriculture; what shall we call it in the case of India where such export not only continues unabated but grows from year to year. It is needless to labour the point, however, for it is one on which there can be no difference of opinion. It is when the prohibition or restriction of export is suggested as a remedy that difficulties are raised. It is "interference with the normal course of trade; the supplier should be free to sell to the purchaser who is willing to pay the highest price. The high price of oil seeds in the foreign markets is really a boon to the agriculturist himself who

is thereby able to get a higher price for his produce than what he would if the export be forbidden and he be forced to sell only in the Indian market. After all, again, how many ryots use bone-meal or oil cakes as manures? It is only a handful of planters a mere drop in the ocean compared with the agricultural population of India, who use these manures and whom such a restriction may benefit, if the anticipated results, such as a diminution in price do follow which itself may be considered problematical." Arguments of this kind powerfully support a policy of *laissez faire*. What we would invite attention to is that even more powerful arguments have been adduced in the debate referred to which nevertheless failed to secure the support of the house. As regards the difference between export price and the controlled home price, the Secretary stated that in every case the former would be considerably higher and specified in the case of superphosphate the export price was £ 50 a ton while the controlled price for the home market was only £ 23-10-0. The case for the exporters was ably argued, that the export trade was very big, that there were several manufacturers engaged and that the measure would materially affect them and cause discontent. One member argued, "If superphosphates are wanted abroad and they can be manufactured here and exported, it will pay us much better to allow free trade. If the British farmers want to buy local produce, they have the option of paying for it, less insurance and freight, and that alone I should think is all they need." None of these arguments availed and the house favoured the restriction of the export. We wonder if Indian Agriculture will ever enjoy this measure of protection.

SELECTIONS.

I

Soil Factors affecting the Toxicity of Alkali.

The aim of the investigations described was to determine as exactly as possible the quantity of the various salts necessary to crops in arid soils. Over 12,000 determinations were made of the effect of alkali salts on the germination and growth of wheat under varying conditions.

In sand cultures the size of the particles does not influence the toxicity of the alkali. Loam soils tolerate alkali better than sand or clay. When the coarseness of the loam varies, moisture is an important factor with regard to the tolerance of alkali as is seen by the behaviour of the plants.

Organic matter increases the resistance of plants to alkalis when the soil contains sufficient moisture but if the content in organic matter is high and the moisture supply low, the power of resistance decreases. In general the resistance to alkalinity increases with the moisture content up to the maximum for a good crop.

The toxicity of sodium chloride and sulphate seems to depend to a certain extent on the relation between the salt concentration and the percentage of moisture, but the toxicity of sodium carbonate is largely influenced by the presence of organic matter which removes large quantities of sodium carbonate from the soil solution.

Conclusions.—(1) Loam soils and soils with a high water-holding capacity may be successfully cultivated even though their alkali content is in excess of that of other soils.

(2) Soils in which alkali decreases the yields should be kept as moist as is compatible with good plant growth.

(3) Manure or other organic matter, may prove beneficial to alkaline soils, especially those rich in carbonates.—*International Review of the Science and Practice of Agriculture. Harris, F. S. and Pittman, D.W., in the Journal of Agricultural Research, Vol. XV, No. 5.*

II

The Sugar-cane Borer and its Control.

The following is extracted from the concluding part of Bulletin No. 94 of 1919 of the Department of Agriculture, Bombay.

The conclusions may therefore be summarised as follows:—

- (1) That sugar-cane plants above three months old are very much less attacked by borer than younger plants.
- (2) That very young plants are not seriously liable to attack until they are three weeks old or older.
- (3) That canes planted in January or earlier in December are more likely to escape attack than cane planted in March or April.
- (4) That cane plants should be three months old if they should escape being attacked by the borer which becomes active soon after the end of February in the Deccan.

Recommendations.—The detailed observations that have up till now been made on this borer allows definite recommendations to be made to control this pest. The cane should be planted as early as possible. The first week of January will suit the conditions of sugar-cane cultivation much better than December as in the latter case the germination of cane is retarded to some extent. Planting cane in January would besides reduce the number of waterings to a certain extent and where the amount of water is limited this will be considered an advantage.

Soon after the harvest the stubbles should be dug out and the roots exposed to the sun. Ploughing the land up does this sufficiently well and prevents any tillering of the stubble. These shoots help the borer to tide over a critical period of its life.

Ratooning the cane is again not advisable for the same reason. Besides perpetuating the trouble from Fungoid diseases the young shoots that spring in March afford ample scope to the borer to live upon them. The borer is particularly active soon after it emerges out of hibernation.

Maize or jowar may safely be grown in these fields either for fodder or grain. There is no chance of the borer in maize or jowar to live on sugar-cane.

. III.

Observation of Growing Seeds.

In all nature study the observation of the development of the young plant from the seed is always emphasized. It is however rather a difficult matter to watch this development in a normal manner. To take up the little plant at intervals to see how it is getting on, causes an unnatural growth. The *Scientific American*, in a recent number, suggests the following simple plan. An ordinary glass jar is lined with thick paper of a somewhat light colour, the interior of the jar is then filled with damp sand or sawdust, which must be kept in a moist state. The seeds to be observed are then pushed down in between the paper and the jars. A brown-paper bag or other covering of dark material is employed to keep away the light from the outside of the jar. The moisture from the sawdust or the sand soaks freely through the paper in the jar, and the seeds thus secure all the water needful for their development. At all stages they can be freely examined through the glass without disturbing them in any way, and thus an excellent idea of the manner of growth under fairly normal conditions is obtained.

IV.

Uses of Castor Oil.

An article in the *Wealth of India*, August 19, 1919, draws attention to various purposes for which castor oil is employed in modern industries. Castor oil, it states, figures to a large extent in the manufacture of the artificial leather which takes the place of natural leather in upholstery. Castor oil is also an essential component in some artificial rubbers and various kinds of celluloid. Castor oil furnishes a colouring for butter; and from castor oil is produced the so-called 'Turkey red oil' which is an important factor in the dyeing of cotton textiles. One of the largest uses of castor oil is in the making of transparent soaps. Castor oil also yields sebacic acid which is employed in the manufacture of candles, and from it is obtained caprylic acid, which enters into the composition of varnishes peculiarly suitable to the polishing of all kinds of high class furniture and of carriage bodies. Castor oil is also used in the making of certain water-proof preparations. Most fly papers also owe a large part of their effectiveness to the fact that the preparation smeared on them largely consists of castor oil.—*Agricultural News*.

Hints on Sweet Potatoes.

A description of the method of cultivating sweet potatoes was published and distributed by the Department of Agriculture some months ago, but the following additional hints may prove useful at the present time to those who have had no previous experience of this crop.

It is advisable, during the period of active growth before maturity, not to allow the long trailing branches of the plants to root at the nodes. The branches should from time to time be turned back towards the centre of the ridge on which the plants are grown. The object of this is to secure a better yield of good tubers from the main roots.

If, when the plants have reached maturity, no immediate use can be found for the whole crop, it is better to leave those that are not required in the ground rather than to attempt to store them. It is, however, important to remember that those mature plants that it is intended to leave in the ground for digging at a later date should be allowed to trail and spread over the ground for digging at a later date should be allowed to trail and spread over the ground without further disturbance. As the tubers on the main roots are already mature there is no object in continuing to turn over the branches as described above, and this treatment, if continued after maturity, is likely to result in killing the plants.

It is stated by those who have had experience in the cultivation of sweet potatoes that by adopting the above methods the tubers can be kept in good condition in the ground for several months.

If for any reason it is found to be necessary to lift a larger quantity of sweet potatoes that can be made use of at once, great care should be taken not to bruise those tubers that it is intended to store, and they should be thoroughly dried in the sun before being taken to the store. The building used for storing sweet potatoes should be as cool and as dry as possible. In this way it should be possible under favourable conditions to keep the tubers in good condition for two or three months, but the better plan is to keep them in the ground until required, as already described.

There are several varieties of sweet potatoes, which vary in the period of reaching maturity from 3 to 6 months. It is, therefore, obviously desirable to take care that cuttings of different varieties are not indiscriminately mixed in planting.

It has been found by experience that cuttings taken from abandoned areas or areas in which sweet potatoes have been grown merely as a cover crop for a considerable time do not give satisfactory results. Care should be taken to select cuttings from properly cultivated fields.

In addition to the ordinary practice of boiling and eating sweet potatoes in a fresh state, the following methods of preserving the tubers for use, as required, are well known and practised in China, and may be adopted with advantage in cases in which crops are likely to exceed immediate requirement.

Dried Sweet Potatoes.

The fresh tubers should be washed, peeled, and steamed until about three-quarters cooked. They should then be cut into segments lengthwise, spread out on mats or in baskets, and thoroughly dried in the sun for three days. They will then be in a tough condition and ready for keeping for a prolonged period, but, as there will still be a certain amount of moisture on the surface, they should be sprinkled with the powder obtained from No. 3 broken rice before being put away. If after several months it is found that dried sweet potatoes are too tough to be eaten with enjoyment they can be softened by re-steaming.

Sweet Potato Biscuits.

The fresh tubers are cut into thin transverse slices. These slices are then fried in lard in the same way as ground-nuts are fried, and are afterwards dipped in liquid sugar. After drying, the biscuits should be kept in air-tight tins and will keep as well as any other biscuits. My informant considers that sweet potato biscuits are superior to any European biscuits.—*Agricultural Bulletin of the Federated Malay States, Vol. VII, No. 6.*

VI

The Carbonation of Burnt Lime in Soils.

A paper on the above subject by Dr. Walter Hoge MacIntyre, of the University of Tennessee Agricultural Experiment Station, was published in *Soil Science*, May 1919. The general introduction to the paper reviews the question of liming in so striking a manner that its reproduction will doubtless prove interesting and profitable to readers of this Journal.

It is to be remembered that the subject dealt with in the investigation is not the general question of the advisability of applying lime to soils, but the conversion, after application to soils, of quicklime or slaked lime into carbonate of lime.

The practice of applying burnt lime to soils has long been followed as one of the fundamental agricultural arts. Particularly is this true in European countries. The scientific principles involved in the practice are, however, of but recent and partial development. From modern investigations, more particularly in the laboratory, it is now known that the benefits derived from the use of lime are due to its effects upon conditions, physical, chemical and biological. The amelioration of unfavourable physical conditions; the eradication of various chemical soil constituents of an acid or toxic nature; the supplying, directly or indirectly, of plant food requirements; and biological betterment have been urged as compelling independent or collective reasons for the application of lime to soils. Even in some newly cleared virgin soils liming is found to be shortly or immediately a profitable treatment; while in the rejuvenation of worn-out and abandoned soils, liming is often found to be a prerequisite.

With the advent of improved appliances and machinery for tillage and with the development of more intensive cultivation, the transported calcareous soils of more recent origin are now more rapidly depleted of their lime contents. Better aeration results in greater oxidation of soil organic matter, and it follows that the soil solution will become richer in carbon dioxide. Thus a stronger solvent will be furnished for the dissolving and leaching of mineral calcium carbonate, or for the hydrolysatation and leaching of other forms of lime. Data upon this phase of the subject have been reported by Hall who states: 'The Rothamsted soil, which at the beginning of the nineteenth century, must have contained something like a hundred tons of chalk per acre, has now less than fifty, and many other soils which started with a smaller initial stock are beginning to run dangerously short'. Additional data concerning the conservation of lime have been reported also from various American agricultural stations, and by Gilchrist and others.

The development of modern crushing machinery and the advent of byproduct limestone have given a healthy stimulus to the use of lime in the form of ground rock. As a result the term 'liming' has become a synonym for application of either burnt lime or ground limestone. In ancient times the soft chalks of Europe were dug and

made available by being brought to a state of fineness through exposure to the disruptive action of weathering.

The application of either burnt, air-slaked or water-slaked lime to soils is followed by the phenomena of absorption and carbonation in sequence, or in the reverse order. The existing soil moisture conditions, and the manner of applying or incorporating will be the deciding factors in determining the order of the changes. If the application is in excess of the immediate absorption co-efficient, formation of calcium carbonate from the unabsorbed lime will ensue. The term 'immediate lime absorption co-efficient' is here used because of the fact that it has been shown by the writer that there occurs a progressive decomposition of calcium carbonate and absorption of calcium by soil, when soil and calcium carbonate continue in contact under most conditions. This slow, continued absorption, subsequent to the initial rapid absorption, may continue over a period of years. The phenomenon has also been demonstrated by Bouyoucos and Laudeman in a different manner over shorter periods. Therefore an ultimate quantitative chemical comparison between the activities of burnt lime and natural lime rock in soils may well be based upon periodically determined occurrences of CaCO_3 . Such a requirement necessitates a careful study of the factors influencing or controlling the carbonation of burnt lime in soils.

A lengthy study of the subject then follows, as the result of which it is stated that :—

The experiments as a whole point to certain definite facts which have practical application. Among them are the following :—

1. CaO and $\text{Ca}(\text{OH})_2$ in 2 to 4 ton applications will revert to the carbonate more rapidly when left on the soil surface than when mixed with a dry mulch of the moist soil.

2. If an oxide or hydrate application is left on the soil surface for several days prior to inworking, the treatment is in effect an application of finely divided CaCO_3 .

3. Surface applications of oxide and hydrate will, for the most part, revert to the carbonate more rapidly during humid atmospheric conditions.

4. If the oxide or the hydrate is incorporated with the upper zone of the soil, prior to a more thorough dissemination throughout the soil, the concentration thus effected will bring about in the treated zone a temporary and partial sterilization which may have certain beneficial results.

5. The avidity or affinity of CaO is for moisture, and when this is furnished by the aerial and soil atmosphere and soil moisture, there is no tendency to effect any chemical disintegration of soil organic matter.

6. Neither CaO nor $\text{Ca}(\text{OH})_2$ can be considered as chemically destructive of soil organic matter when used in the manner and in the amounts to be considered as practical applications.—*Agric. News, Vol. XIX, No. 465.*

VII.

Tapioca Cultivation.

(1) *Soil and drainage.*—The crop is grown in all kinds of soils which are well drained. It is a common crop in the sandy tracts of Ponnani taluk and laterite slopes and valleys of the other taluks of Malabar. In virgin red loamy soils the crop yields very heavily. Drainage is a very essential condition for the success of all crops. This is particularly true of a root crop like tapioca. The land which would not admit of free drainage should never be selected for the cultivation.

(2) *Season.*—This commences with the outburst of the south-west monsoon and extends up to October according to the nature of the soil. In low-lying situations where there would be sufficient moisture in the hot weather and too much of it in the monsoon planting may be delayed up to October. But the best time for planting in high-lying dry lands would be July-August.

(3) *Sites for planting.*—The crop is propagated by planting the stem. Green stems having very close leaf scars hardy and less pithy and as a consequence least liable to white-ant attacks are to be selected. They are cut into setts, 6 to 9 inches long, and the bottom ends which go into the ground are dipped into ashes and are pressed down into the soil leaving about three inches above ground. The planted setts are to be covered but lightly with paddy straw or some dried leaves.

(4) *Preparation of land and systems of planting.*—There are three systems of planting, namely (a) ridge, (b) mound, (c) flat.

(a) *Ridge.*—In this system the ground is ploughed two or three times. The turfs and weeds are collected and heaped in rows three feet apart. From between the rows earth is taken and thrown on either side, covering the turf so as to form ridges about 1 to $1\frac{1}{2}$ feet

high leaving just a foot wide trench in the middle. On the crust of the ridges setts are planted two feet apart.

(b) *Mounds*.—Ridges are formed as above, but narrow cross channels are made separating the long ridges into little mounds. Each of these little mounds receives a sett.

(c) *Flat*.—In this system the ground is well dug with mammutti to $1\frac{1}{2}$ feet deep. First a furrow is made close to the boundary bund, and leaves are applied along the furrows. The first furrow is then covered with earth taken out for making the second furrow and this latter is covered with the earth from the third furrow. Thus the whole field is worked up. Along the row supplied with leaves as stated above setts are planted. The same distance between setts, namely, 3 feet by 2 feet, is maintained in all the three systems. The flat system is the best; the heaviest yield is obtained when this is followed.

(5) *Manuring*.—In virgin lands much manuring is not necessary for the first trial. The crop is an exhausting one and, as such, it requires heavy manuring. A handful of a mixture of well-rotten cattle manure and ashes is to be applied to each sett either at the time of planting or six weeks after, at the time of hoeing and weeding. This fish manure compost at the rate of one handful per plant has given excellent results.

(6) *After cultivation and harvest*.—The crop has to be hoed and weeded twice at intervals of about two months. It is ready for harvest after eleven months. If there is sufficient moisture in the soil, harvest can be done by pulling out the stems. The broken roots, if any, are dug out separately. The yield varies from five or ten thousand pounds per acre. The value of the yield at the present price of one rupee per maund of 28 lb. would be over Rs. 200. The roots must be washed and skin removed. Then it may be cooked and eaten. It would be advisable to screen off the water in which it is boiled. For marketing purposes roots are cut into chips after washing, and dried well in the sun. In this condition large quantities of roots are exported from Cochin and Travancore. When the roots are not required for immediate use they can be preserved long when dried, as stated above. Out of the tapioca flour nice cakes can be prepared according to one's taste.—*Leaflet by the Madras Department of Agriculture.*

The World's Supply of Sugar.

The Situation Reviewed.

Great interest has been taken in the extensive enquiry being made at present in connection with the development of India's supply of sugar, and, no doubt, as the questions are thoroughly worked out there will come some valuable suggestions which will help to make India even more a great sugar-producing country. The question has an added importance on account of the great dearth of sugar throughout the world, a deficiency which is causing the greatest concern. The failure of the war-stricken countries to return to normal conditions is not unexpected or surprising, but so long as the present conditions continue, large classes are bound to suffer severely from the lack of certain materials. Recently in the Indian Trade Journal appeared a comprehensive review of the world situation as far as the supply and demand for sugar is concerned, and it is quite clear from that, that many years will pass before the supply equals the demand, that is, before we can hope for anything like a return to the prices that prevailed before the war. We may refer to one or two interesting measures of the important article referred to.

The rise in prices is felt in India, but as the people use jaggery and large quantities are produced in the country itself, the pinch is not felt as in other countries. India has the largest acreage under sugar-cane, but the produce is not sufficient for her needs, so that she has no contribution to make toward the needs of other parts of the Empire. In most of the other countries where sugar is grown, either as beet or cane, the produce is scarcely sufficient to meet the needs of the people of those countries, whereas in many, large quantities have to be imported. In tropical countries the sugar-cane is grown in great quantities, in more temperate countries the source of the supply is beet. Interesting statistics are given showing how these two sources have been developed. In the case of beet sugar in 1840, the produce was only 4 per cent of the world's supply; in 1870 it had become 34 per cent; between the eighties and nineties it rose to 50 per cent while, in the next ten years, beet sugar constituted three-fifths of the world's total output of sugar. Toward 1890 the dominating position of the beet sugar industry threatened ruin

to its rival but as the result of various conferences, the two industries were placed on a more even footing.

So far as the cane-producing countries are concerned, there has been a steady development. In 1904 the world output, excluding India, was 4,776,000 tons, but in 1919 the total was 9,686,000 tons. From most of the cane-growing countries a large export trade is carried on, as the proportion required by the population is small compared with the output. Cuba's production in 1913 was 2,597,000 tons, and her consumption was about 200,000. Since then the production has greatly developed, so that in 1919 it rose to nearly 4,000,000. This vast excess will be available for other countries, but when it is remembered that England alone is short by 700,000 of her sugar needs it will not be difficult to see that there will be great demands for it. But when we turn to the beet sugar-producing countries we find that the situation is critical. Six years ago the beet supplied 46 per cent of the total sugar of the world, but since then it has steadily decreased. In 1919 it was only 27 per cent. In France out of the 206 factories existing before the war only 61 could work in 1919; in Germany the consumption was 1,650,000 tons and her production only 1,250,300 tons: on account of the great shortage of labour and artificial manures 116,000 acres less were sown in 1919 than in 1918 and she will require this year no less than 500,000 from other sources. In Russia the same conditions prevail. Her pre-war consumption was 1,180,000 tons and production 1,403,000 leaving 220,000 for export: her total output for 1919 was estimated at 700,000 tons and in 1920 it will probably be about 300,000 tons. Conditions are so unsettled in Austria-Hungary that there is no possibility of her producing half of the amount she used to produce before the war, *i.e.*, 1,400,000 tons. The figures given for France show that she used to consume 645,000 tons and produce 670,000 tons, but in 1919 her production fell to 110,000 tons of refined sugar and she had to import 440,000 tons; Holland, Denmark, and Czecho-Slovakia may have small quantities in excess, but these will do little toward making up the large deficiencies in other countries.

Before the war, Germany and Austria-Hungary used to supply over one-half of the United Kingdom's requirements, but owing to the stoppage of these supplies Great Britain began to import from Cuba, Mauritius and Java. Though she got large quantities from these places her total sugar supply decreased by 500,000 tons. Both in America and England the demand is likely to be much greater

than in the past, and against this is the reduced output of beet sugar. In several parts the supply of cane sugar is threatened with a serious decrease through climatic and other causes, which will diminish the increase expected. The writer sums up the situation in the following paragraph :—" European beet sugar production, instead of showing any recovery from the effects of the war will this year be actually less than last year. The shortage of this beet sugar is being partially met by the increase in cane sugar production outside Europe, but as the world's consumption of sugar is on the increase, great efforts are required on the part of the sugar-cane industry to try to meet the deficiency of beet sugar and to supply the normally-increasing demand. High prices are thus bound to prevail in sugar until cane sugar production increases to this extent or beet sugar comes to its own again. Thus a great future opens to all countries who are not faced with insuperable difficulties as regards increasing their output, while those countries who spent money in the past in putting their sugar industry on a sound basis are now reaping an ample reward in their energy and foresight."

IX.

Scheme for Survey of a Village.

General instruction.—Embody in your report the official information which is available, but endeavour also to test its accuracy and to correct it when possible. Use some distinguishing mark to indicate whether your information is derived from official sources. Thus the letter 'O' can be used to mark official information, 'N' unofficial, and 'N and O' official information confirmed by non-official.

YOU ARE REQUESTED TO GIVE SPECIAL ATTENTION
TO QUESTIONS MARKED WITH AN ASTERISK (*).

*If you cannot answer all or most of the questions,
replies to those marked * will be useful.*

PRELIMINARY—

- (1) Survey number of village.
- (2) Name of village.
- (3) Taluk.
- (4) District.
- (5) General description of geographical position and position in relation to any forests, rivers, hills, etc., which there may be in the neighbourhood.

(6) Is the village Ryotwari or Zemindari?

A. POPULATION—

- (1) Total population of caste village.
- (2) Castes.
- (3) Number of families and individuals in each caste.
- (4) Number of children in families—
 - (a) living.
 - (b) dead

N.B.—A good way of getting this information is to ask parents how many children they have had and how many are still alive.

- (5) Number of homesteads.
- (6) Give the statistics of the births and deaths given in the village accounts, and try to ascertain to what extent they are accurate; and if defective, why so?
- (7) Population—men, women, and children—of Paracheri, given if possible in families, with number of dead in families.

Notes.—(a) Endeavour to give, if possible, the population according to the last two or more censuses.

(b) Use the figures so obtained to ascertain whether the population is increasing or decreasing, and if so, which sections of the population (caste and sex) show the increase or decrease.

(c) State the age you choose to distinguish between children and others. This should be ten years or fifteen years.

B. LAND—

- (1) Total area.
- * (2) Area of wet lands.
- * (3) Area of cultivated dry lands.
- * (4) Area of lands watered by wells.
- (5) Common waste.
- (6) Pasture other than common waste.
- (7) Woods and Forests.
- (8) Fruit trees and scattered shade trees.
- (9) Tanks.
- (10) Wells.
- (11) Other sources of water-supply.

Note.—The information under B can mostly be obtained from the village accounts, but some correction may be necessary. *Make, if possible, a copy of the village map.*

- (12) Add any information with regard to changes in the above in recent times, procurable either from village records or the memory of inhabitants (*e.g.*, has the cultivated area increased? Has common pasture become scarce?)

C. OCCUPATION OF LAND—(If Ryotwari).

- (1) Area cultivated by the owners.
- (2) Area sublet and cultivated by tenants.
- (3) Number of cultivating owners.
- (4) Number of non-cultivating owners and their respective occupations.
- (5) Number of tenants who have no land of their own.
- (6) Agricultural workers who neither own nor rent land.
- (7) Give an account of the sizes of the properties according to area and amount of assessment.
- (8) Give a similar account of the sizes of the holdings of cultivating ryots, whether these own lands, or hire land from owners.
- * (9) Rents in money or in kind.—Give an account of the agreements usual between owner and tenant, and the amount of the rents paid for different classes of land.
- * (10) Land Revenue.—Give total assessment of village and amount per acre for different qualities of land.
- (11) Particulars of people who combine agriculture with other occupations.

Notes.—(a) If the village be jodi, explain the economic relations between the jodidar and the tenants directly under him, and between these and sub-tenants, if any; and give the information corresponding to that asked for ryotwari villages.

(b) Under (9) give as full information as possible both about the sorts of agreements that are concluded between the landlord and the tenant, and also the amount of the rents, and what extras, such as straw, vegetables, etc., are paid in addition to grain or cash rents. If landlord and tenant share the produce, explain how the assessment and costs of cultivation are shared, and whether the tenant has all the straw; and endeavour to calculate the actual value of the share of produce obtained by either party.

D. AGRICULTURE—

- (1) Area under each of the principal crops.
- (2) Area yielding one crop per annum.
- (3) Area yielding two crops per annum.
- (4) Area yielding three crops per annum.

N.B.—Give these statistics for a short series of years.

(5) Customary crop cultivation, of wet, dry, and garden lands respectively.

* Most particularly note, in the case of dry crops,

- (a) the time usually available for ploughing, sowing, and harvesting respectively.
- (b) the time required to plough, sow, and reap a defined area (*e.g.*, 1 acre).

In the case of paddy,

- (a) the above particulars;
- (b) the time available for transplanting, and the number of days' work required to transplant a given area (*e.g.*, 1 acre);
- (c) whether single transplantation is customary.

In the case of crops other than paddy,
whether the period when they require the expenditure of labour comes at the same time of year or not as the busy time for paddy cultivation.

*(6) Types of plough used, and the number of acres cultivated per plough in wet, dry and garden land respectively.

(7) Other agricultural implements.

(8) Describe types of pumps or waterlifts used (no elaborate description is needed if they are of common types). Are oil engines used?

(9) Is water sold for irrigation by one villager to others?

If so, what price is charged?

*(10) Stock,—(a) Working oxen.

(b) Cows.

(c) Male buffaloes.

(d) Cow buffaloes.

(e) Young stock of above species.

(f) Horses.

(g) Donkeys and mules.

(h) Sheep.

(i) Goats.

(j) Pigs.

Note.—In obtaining the answer to this question you must not rely upon official information, but make independent enquiries.

(11) Are ploughs or carts and bulls hired out?

If so, give rates of hire.

(12) Describe the customs with regard to feeding of domestic animals, particularly noting whether common pastures or private pastures are available.

(13) Manuring.—(a) What percentage of the cattle dung produced is used as manure?

(b) What quantity of cattle dung is applied per acre of wet, dry and garden land?

(c) How is cattle urine utilized?

(d) Other animal manures.

(e) Green manure.

Under this head explain whether green manure is grown, or obtained from woods or forests.

(f) Are chemical manures used? If so, how obtained?

(14) Garden cultivation. Describe methods.

(a) How many cocoanuts does one tree yield on the average per year?

(b) What is the value of the yield of an acre of land under (1) vegetables, (2) plantains, (3) tobacco, (4) any other special crops grown?

(15) Chief insect pests and methods of combating them.

(16) Chief cattle diseases and methods of combating them.

Under head (15) and (16) note particularly whether assistance is obtained from the Agricultural and Veterinary Departments.

(17) How and where is wood obtained for fuel, implements, buildings, etc.?

*(18) Give estimates of the costs of cultivation and gross outputs of as many important crops as possible, stating the source from which you get your information.

(19) Has there been any recent improvement in methods of cultivation, as single transplantation of paddy, seed selection of cotton, introduction of new crops, etc.? If so, how was such improvement brought about? Are the villagers disposed to adopt new methods if their utility can be demonstrated?

*(20) Do the villagers breed their own cattle, or purchase? If the former, give as full an account as possible about their methods of breeding and rearing young cattle; if the latter, state how the cattle are procured, what breeds are preferred, where they come from, what prices are paid, and what becomes of the cattle afterwards.

*(21) How much milk does (a) a cow, (b) a cow-buffalo, yield on the average per annum?

*(22) Is there a tendency for holdings to become through repeated sub-division too small to maintain the holder and his family?

In case there are many such very small holdings, what opportunity has the small holder of getting other remunerative employment, as by carting, or carrying on some small industry, or working for other villagers, or for some employer outside the village?

*(23) To what extent do holdings consist of many scattered plots of land? (This condition is called 'fragmentation').

Is much inconvenience experienced as a result of fragmentation? (*e.g.* in waste of time in passing from plot to plot, reluctance to sink wells, or manure heavily, disputes, waste of land in bunds for small plots, inconvenience of access, unnecessary winding in and out of water-channels).

Do ryots exchange lands in order to get their lands contiguous? If so, do they build field huts where they have several acres in one spot?

E. THE VILLAGE—

- (1) Area of the village site.
- (2) Do the different castes occupy separate parts of the village?
- (3) Describe the dwellings of the depressed castes.
- (4) Types of dwellings, *e.g.* (1) tiled, (2) thatched, (3) two-storied houses.

How many houses are there (a) in caste village?
(b) in paracheri?

- (5) Are there gardens adjoining the dwellings?
- (6) What is the maximum distance of cultivated lands from the home of the cultivator?
- (7) Is there an unsatisfied demand for building sites?
- (8) Site values, give price of a given area.

F. SUBSIDIARY INDUSTRIES—

- (1) Number of weavers.
- (2) Condition of the weaving craft :—What yarn is used ? What looms and winding implements ? Do weavers co-operate at all ? What evidence is there of growth or decay in the weaving industry ? Give average earnings.
- (3) Is hand-spinning practised ? if not, when abandoned ?
- (4) List of other crafts in the village, giving when possible the proportion of working time spent on the craft, average earnings and any interesting features about the craft.
- (5) Give any information available showing whether any village industry is developing or increasing ; or, on the other hand, dying, decaying, or becoming less remunerative.

G. VILLAGE TRADE—

- (1) How do the villagers purchase commodities required—
 - (a) for industrial and agricultural use ?
 - (b) for their own consumption ?
- (2) Sale of village produce—
 - (a) Estimate the quantities of village produce sold out of the village.
 - (b) Describe the methods of sale.
- (3) Condition of village with regard to local roads, access to main roads, railways and commercial centres.
- (4) Extent of co-operation (if any) in village trading.
- *(5) How much agricultural produce is sent away from the village in an average year ?
- (6) Do the poorer ryots sell grain at a low price immediately after harvest, and have to buy it back for their own food or for seed at a higher price later on ?
- (7) How does the price the ryot receives for his produce compare with the prices obtained in the nearest large market ?
- *(8) Give an account of the *quantity* and *quality* of the food ordinarily consumed by typical families of different status.

H. ECONOMIC CONDITION OF VILLAGE—

- *(1) Customary rates of wages (a) in money, (b) in kind.
 Note what extra perquisites are given to the labourer in addition to his regular wage.
- *(2) Current prices of staple foods. Try to calculate how much food a landless labourer's family can obtain for its total annual wages.

- (3) How many families have made savings?
- (4) Utilization of savings—
 - (a) Agricultural or industrial capital.
 - (b) In Savings Bank.
 - (c) On loans to neighbours.
 - (d) In jewellery.
 - (e) Other methods.
- * (5) Extent of indebtedness.
- * (6) Number of coolies bound over by money advance and conditions of their service to creditors, stating amount of wages or allowances of grain, clothing, etc.
- * (7) Causes of indebtedness.
- (8) What rates of interest are ordinarily paid for different sorts of debts, whether in money or grain? Is the real rate of interest ever higher than the nominal rate, by manipulation of prices?
- (9) Proportion of debtors who have liberated themselves from debt.
- (10) Is there a co-operative credit society? If so, add a special appendix giving the fullest possible account of its origin, progress and prospects. Is it reducing the village indebtedness?
- (11) Sources and extent of communal income (*i.e.*, income belonging to the village as a whole, and not to individual villagers).
- (12) Expenditure of communal income.
- (13) Administration and supervision of communal income.
- (14) Give any particulars known about selling prices of land.
- (15) Estimated annual expenditure on religious festivals.
Are such festivals in honour of a village goddess?
- (16) Estimated expenditure in recent years on new temples.
- (17) To what extent is advantage taken of the Agricultural Loans Act, and the Land Improvement Loans Act?

I. SANITARY CONDITION OF VILLAGE—

- (1) Prevalence of Malaria.
- (2) „ Cholera.
- (3) „ Plague.
- (4) „ Tuberculosis.
- (5) „ Small-pox.
- (6) „ other epidemic diseases.

- (7) Prevalence of other endemic diseases.
- (8) Estimated rate of infantile mortality.
- (9) Snake bites.
- (10) Medical assistance available.
- (11) Insanitary habits.
- (12) Prevalent customs with regard to—(a) Infant Marriage.
(b) Purdah.
- (13) Nature and quality of water-supply for drinking and domestic purposes.
- (14) Do the villagers bathe and wash clothes in the same stream or tank as that used for drinking?

J. EDUCATION—

- (1) Number of schools.
- (2) School accommodation.
- (3) Educational character of schools.
- (4) Number of boys in attendance.
- (5) Number of girls in attendance.
- (6) Average duration of school life.
- (7) Percentage of adults able to read the vernacular.
- (8) " " to write the vernacular.
- (9) " " to talk English.
- (10) " " to read English.
- (11) " " to write English.
- (12) Number of pandits or specially educated persons.
- (13) Are there any adults who have learnt to read, to write or to cipher who have lost such ability after leaving school?
- (14) Number of boys and girls who have proceeded to more advanced schools elsewhere.
- (15) How have their school expenses been defrayed?
- (16) Have boys from the village who have passed through secondary schools obtained satisfactory careers later on?
- (17) Have any gone to an Agricultural College?
- (18) Have any boys who have received a good education settled down in their own village? If so, how do they use their education?
- (19) How many books and of what character in the village?
- (20) Are there recitations of poems in the vernacular or dramatic performances? If so, give a description.

K. VILLAGE ADMINISTRATION—

- (1) Panchayat.
- (2) Village administration.
- (3) Sanitary administration.
- (4) Police administration.
- (5) Contact with higher authorities.
- (6) How much crime has there been in recent years?
- (7) Are any of the villagers engaged in litigation? and if so, why? Are any in debt in consequence of litigation?
- (8) Are offences and civil disputes dealt with in the village without resort to the Courts?

L. HISTORY AND PROSPECTS OF VILLAGE—

- * (1) What evidence is there to show either economic deterioration or economic improvement in the past?
- * (2) What opportunities does the village seem to have for economic improvement? Note specially the possibility of extending the area of irrigated lands. Could more wells be sunk with advantage? If so, why are they not sunk?
- * (3) General.—*If opportunity offers, illustrate by giving a more detailed account of the occupations, income, expenditure and the general condition of a few typical families. Add any information which appears to be interesting and significant not asked for in this form; as for instance, information as to the decrease of land held by different castes, reasons why people buy land and why they sell it, the emigration from the village either to cities or to foreign countries, why the emigrants go and whether they return, what effect such movements have upon the economic, intellectual, and social life of the village; what new expenditure on luxuries or comforts is becoming customary; what other changes there are in the standard of living; and if there is any change in custom with respect to marriages or religious observances.*

Department of Indian Economics, University of Madras.

Notification by the Director of Agriculture in Mysore.

OFFICE OF THE DIRECTOR OF AGRICULTURE
IN MYSORE, BANGALORE.

March 25th 1920.

Circular No. C. 641.

As requisitions for candidates to fill the posts of Managers of private estates are being received by the undersigned, the passed students of the Agricultural School desiring employment are requested to have their names registered in this office with details of the minimum emoluments and other conditions which would induce them to take up such service. The availability of these posts will from time to time be intimated to those whose names have been registered.

LESLIE C. COLEMAN,
Director of Agriculture.

Italian Seed Potatoes.

The following letter, dated 8th October 1920, from the Union Agency, Limited, 431, Somwar Peth, Poona City, is published for general information :—

“We feel great pleasure in announcing that we expect to deliver fresh stock of Italian Seed Potatoes every fortnight beginning from the first week of November to the end of December. We intend selling these at as low a rate as possible charging over dealer's cost a small amount to cover the cost of fumigation and selection whenever necessary. We may state that, including this trifling cost, the rate per maund of 28 lbs. will not exceed Rs. 5 delivered at our Poona Depôt. The actual rate can only be fixed on arrival of each consignment after inspecting the condition in which it is received. We guarantee this maximum only to those who will register their orders during the month of October. Unregistered orders will be executed at the market rates prevailing at the time of the receipt of the order, and it is likely that this rate may exceed Rs. 5.

All orders will be executed for cash against delivery at our godown in Poona. No credit can be allowed nor payment by V.P.P. against railway receipt.

All risk of Railway transport shall have to be borne by the customer. We can only help in securing waggon accommodation whenever possible.

All facilities will be given to the customer to inspect the stock he would want to purchase, and labour and carriage will be afforded to him at cost price.

To wholesale dealers, Co-operative Seed Societies, and individual buyers of 50 tons and over, a special discount will be allowed to suit each case. It can be settled on the spot in our office by direct negotiation between the party concerned and ourselves.

Orders placed with cash in advance will receive our first attention and will also be executed at the lowest possible rate, and in addition, a special discount of 1 per cent will also be allowed in return for the cash.

We shall thank you to be co-operative with us in keeping the price of Seed Potatoes as low as possible and thereby strengthening the position of Potato crop by registering your order well in advance not forgetting to accompany it with an amount of money which will approximately cover the cost of the quantity of the Seed Potatoes you require."

EDITOR.
